Math 6410: Ordinary Differential Equations

Fall 2021

August 23, 2021

INSTRUCTOR DETAILS

Instructor: William Feldman (he/him/his)

Office: JWB 101 (name plaque is currently wrong)

Office Phone: (801) 581-4279 (better use email or Zoom)

Email: feldman@math.utah.edu

Webpage: math.utah.edu/~feldman/teaching.html

Zoom room: utah.zoom.us/my/wfeldman

Office Hours: TBA, will be held in Zoom room listed above.

Accessibility and Support: Email is the best way to reach me, I will respond as promptly as I can, but generally expect to receive a response during "business hours". You can also set up a time to meet with me on Zoom or in person at my office.

TA DETAILS

The course also has a graduate TA / grader. He will typically hold one office hour per week. His contact details are included as relevant to the office hour, but for most questions please contact the me.

Instructor: Keshav Patel

Office Hours: TBA.

COURSE DETAILS

Course type: In person

Class time: MWF 12:55PM-1:45PM

Location: Crocker Science Center 25

Webpage: math.utah.edu/~feldman/teaching.html

COVID note: If I am sick or if someone in the class tests positive for COVID we may need to hold some lectures on Zoom. Please be prepared for that possiblity. Any lectures held on Zoom will be recorded. If you need to miss class for any COVID related reason but the lecture will not be on Zoom that day please let me know so I can prepare some kind of accommodation.

COURSE MATERIALS

I will most likely lecture based on different books at different points in the course. I will try to choose sources which are available for free online. You are not required to purchase a book in order to follow the class (homework problems will not be assigned by number etc). If you are interested to have physical reading material many different books cover similar material and would be good companions to the course, see here for a long list assembled by Andrejs Treibergs who has taught MATH 6410 many times.

Primary Textbooks:

Differential Equations and Dynamical Systems, Lawrence Perko.

Ordinary Differential Equations and Dynamical Systems, Gerald Teschl [pdf].

Supplementary Texts:

Theory of Ordinary Differential Equations, Christopher P. Grant.

Additional course materials will be shared online via CANVAS.

COURSE DESCRIPTION

This is the first semester of a year long course on differential equations. This class will cover ordinary differential equations (ODE) and dynamical systems. The second semester (which I will also be teaching) will focus on partial differential equations (PDE). I will provide / remind of most of the background materials needed for the course, primarily undergraduate analysis, linear algebra, and some functional analysis. If you think you

may be missing some background knowledge or I have gone through some background material too quickly please let me know ASAP. If you can let me know in advance that is even better. I am happy to spend time on background material but need feedback to give the right level of detail.

Passing this course with an **A** grade will count as a high pass on the ODE qualifying exam, and passing with a **A**− or **B**+ will count as a pass. The course will also help you prepare for the ODE qualifying exam if you prefer to go that route or are unsatisfied with your grade in the course.

Topics (see also http://www.math.utah.edu/dept/gradbull.pdf)

- **Initial value problems:** Fixed-point theorems; Basic existence and uniqueness; Dependence on initial conditions.
- **Linear equations:** The matrix exponential; Linear autonomous systems; General linear systems; Periodic linear systems and Floquet theory.
- **Dynamical systems theory:** Flows, orbits and invariant sets; Definitions of stability; Planar dynamics and Poincaré–Bendixson; Hamiltonian mechanics; Stable and unstable manifolds; Hartman–Grobman theorem; Method of averaging.
- **Perturbation methods:** Regular perturbation theory, nonlinear oscillations; Poincaré–Linstedt; Singular perturbation theory, method of multiple scales; Boundary layers; WKB methods.
- **Boundary value problems:** Sturm–Liouville problems; Compact symmetric operators; Green's functions; Integral equations; Rayleigh–Ritz method.

IMPORTANT DATES

Exams: Final exam date is Monday, December 13, 2021 at 1:00 – 3:00 pm.

Holidays:

- Labor Day (Monday, Sept 6)
- Fall Break (Sunday-Sunday, October 10-17)
- Thanksgiving Break, (Thursday-Sunday, November 25-28)

GRADING POLICY

- Calculation of final grade:
  - **50%** - Homework - You will be assigned homework assignments on Wednesdays. You may discuss the problems with others, but the final write-up should be all in your own words.
  - **50%** - Final Exam - The final exam is on Monday, December 13, 2021 at 1:00 – 3:00 pm.
- Your final letter grade will be determined by the following rubric:
  - **A** : 90%+
  - **A-** : 85%-90%
  - **B+** : 80%-85%
  - **B** : 70% - 80%
  - **C** : below

  Note that, as per the department's graduate bulletin an **A** in the course counts as a high pass on the ODE qualifier, and an **A**− or **B**+ counts as a pass on the ODE qualifier.
- Double check the accuracy of all recorded homework, online assignments, and exam grades. Also you should keep as record all your graded assignments. If you see any error in your grades on Canvas/Gradescope, reach out to me as soon as possible.

HOMEWORK

Homeworks will be assigned on Wednesdays and due the following Wednesday. Homeworks will be posted on my webpage and should be submitted via gradescope.

LATE ASSIGNMENTS/MISSED ASSIGNMENTS/REGRADING POLICIES

- Homework assignments will not be considered late until 11:59pm on the day they are due. If you need an extension let me know, but this option should be used sparingly and with good reason.
- Regrades: If you notice a mistake in grading you can return your assignment/quiz/test to me to be regraded. You should submit the assignment in question along with a note explaining where you believe the grading error was.

COVID related details

University leadership has urged all faculty, students, and staff to **model the vaccination, testing, and masking behaviors** we want to see in our campus community.

These include:

- Vaccination
- Masking indoors
- If unvaccinated, getting weekly asymptomatic coronavirus testing

Vaccination:

- Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks.
- Many in the campus community already have gotten vaccinated:
  - More than 80 percent of U. employees
  - Over 70 percent of U. students
- Visit http://mychart.med.utah.edu/, http://alert.utah.edu/covid/vaccine, or http://vaccines.gov/ to schedule your vaccination.

Masking:

- While masks are no longer required outside of Health Sciences facilities, UTA buses and campus shuttles, CDC guidelines now call for everyone to wear face masks indoors.
- Check the CDC website periodically for masking updates— https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinatedguidance.html
- Treat masks like seasonal clothing (i.e. during community surges in COVID transmission, masks are strongly encouraged indoors and in close groups outside).

Testing

- If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others.
- Asymptomatic testing centers are open and convenient: Online scheduling Saliva test (no nasal swabs) Free to all students returning to campus (required for students in University housing) Results often within 24 hours Visit alert.utah.edu/covid/testing
- Remember: Students must self-report if they test positive for COVID-19 via this website: https://coronavirus.utah.edu/.